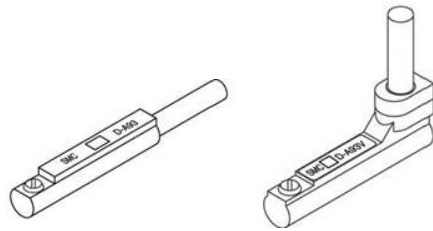




ORIGINAL INSTRUCTIONS

## Installation & Maintenance Manual Auto Switch (Reed switch type) Series D-A90/D-A93/D-A96 D-A90V/D-A93V/D-A96V (Basic Safety Principles according to EN ISO 13849)

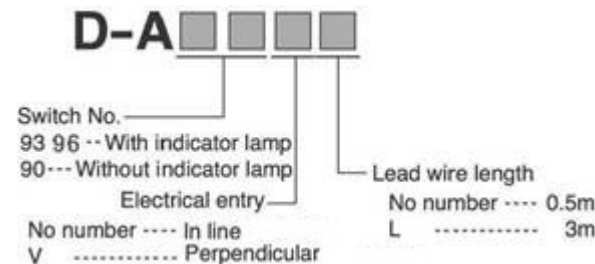


The intended use of the Auto switch is to detect a position of a magnet in a pneumatic cylinder. The magnet is installed in e.g. a piston, a slide table, etc.

This IMM is only applicable for validated products to ISO 13849. Refer to Doc. No. D\*ZZ-SM0116P.

This manual should be read in conjunction with the current product catalogue. Keep this manual in a safe place for future reference.

### Model Indication Method



This product is a reed switch type Auto switch of direct mounting specification.

### Safety Instructions

This product is class A equipment that is intended for use in an industrial environment.

This manual contains essential information for the protection of users and others from possible injury and property damage.

To ensure correct handling, please follow the instructions. Please check that you fully understand the meaning of the following messages (signs) before going on to read the text, and always follow the instructions.

Please read the Installation & Maintenance Manual of related apparatus and understand it before operating the unit.

IMPORTANT MESSAGES	
Read this manual and follow its instructions. Titles such as DANGER, WARNING and CAUTION will be followed by important safety information which must be carefully followed.	
	Indicates a hazard with a high level of risk, which if not avoided, will result in death or serious injury.
	Indicates a hazard with a medium level of risk, which if not avoided, could result in death or serious injury.
	Indicates a hazard with a low level of risk, which if not avoided, could result in minor or moderate injury.

These safety instructions are intended to prevent a hazardous situation and/or equipment damage. These instructions indicate the level of potential hazard by label of "Caution", "Warning" or "Danger". To ensure safety be sure to observe ISO4414 (Note1), JIS B 8370 (Note2) and other safety practices.

(Note 1):ISO 4414:Pneumatic fluid power - Recommendations for the application of equipment to transmission and control systems.

(Note 2):JIS B 8370:Pneumatic system axiom.

### Safety Instructions (continued)

#### ⚠ WARNING

1. The compatibility of pneumatic equipment is the responsibility of the person who designs the pneumatic system or decides its specifications.

Since the products specified here are used in various operating conditions, their compatibility for the specific pneumatic system must be based on specifications or after analysis and/or tests to meet your specific requirements.

2. Only trained personnel should operate pneumatically operated machinery and equipment.

Compressed air can be dangerous if an operator is unfamiliar with it. Assembly, handling or repair of pneumatic systems should be performed by trained and experienced operators.

3. Do not service machinery/equipment or attempt to remove component until safety is confirmed.

1) Inspection and maintenance of machinery/equipment should only be performed after confirmation of safe locked-out control positions.

2) When equipment is to be removed, confirm the safety process as mentioned above. Switch off air and electrical supplies and exhaust all residual compressed air in the system.

3) Before machinery/equipment is re-started, ensure all safety measures to prevent sudden movement of actuators etc. (Supply air into the system gradually to create backpressure, i.e. incorporate a soft-start valve).

4. Contact SMC if the product is to be used in any of the following conditions:

1) Conditions and environments beyond the given specifications, or if product is used outdoors.

2) Installations in conjunction with atomic energy, railway, air navigation, vehicles, medical equipment, food and beverage or recreation equipment.

### Design and selection

1) Confirm the specifications

Read the specifications carefully and use the product accordingly. The product may be damaged or malfunction if it is used outside the range of specifications for load current, voltage, temperature or impact.

2) Take precautions when multiple actuators are used close together To eliminate the possibility of magnetic interference between switches, please ensure that, when two or more actuators are used in parallel, they are kept at least 40 mm apart.

(When the allowable interval is specified for each actuator series, use the indicated value.)

3) Keep wiring as short as possible

As the length of the wiring to a load gets longer, the in-rush current at switching ON becomes greater, and this may shorten the product's life (the switch will stay ON all the time).

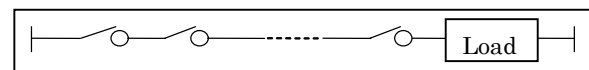
4) Pay attention to the internal voltage drop of the switch

1) Switches with an indicator LED

· If auto switches are connected in series as shown below, take note that there will be a large voltage drop because of the internal resistance of the LED. (refer to internal voltage drop in the auto switch specifications).

[The voltage drop will be "n" times larger when "n" auto switches are connected].

Even though an auto switch operates normally, the load may not operate.



· In the same way, when operating below a specified voltage, although an auto switch may operate normally, the load may not operate.

Therefore, the formula below should be satisfied after confirming the minimum operating voltage of the load.

$$\text{Supply voltage} - \text{Internal voltage drop of switch} > \text{Minimum operating voltage of load}$$

2) If the internal resistance of the LED causes a problem, select an auto switch without an indicator LED (model D-A90/D-A90V).

5) Do not use a load that generates a surge voltage

Please avoid use under the following load conditions, because it could lead to a deterioration of the service life (contacts remain in the on-position).

- use with an inductive load such as a relay

- use with wiring between auto switch and load of more than 5 m in length

6) Cautions for use in a safety related circuit.

Perform periodic maintenance and confirm proper operation in accordance with safety related requirements.

### Design and selection (continued)

7) Ensure sufficient clearance for maintenance.

When designing an application, be sure to allow sufficient clearance for maintenance and inspection.

### Mounting / Adjustment

1) Do not drop or bump the auto switch

Do not drop, bump or apply excessive impacts (300m/s<sup>2</sup> or more). Although the body of the auto switch may not be damaged, the inside of the switch could be damaged and cause a malfunction.

2) Do not carry a cylinder (actuator) by the auto switch lead wires.

Never carry an actuator by its lead wires. This may not only cause broken lead wires, but it may cause internal elements of the auto switch to be damaged by the stress.

3) Mount switches using the correct tightening torque.

If an auto switch is tightened beyond the specified tightening torque, the mounting screws, mounting brackets or switch may be damaged.

On the other hand, tightening below the specified tightening torque may loosen the screw and the auto switch may slip out of the correct detection position.

4) Mount a switch at the center of the operating range.

Adjust the mounting position of an auto switch so that the piston stops at the center of the operating range.

If mounted at the end of the operating range (around the borderline of ON and OFF), operation may be unstable.

### Wiring

1) Avoid repeatedly bending or stretching the lead wires.

Broken lead wires can result from wiring applications which repeatedly applies bending stress or tensile force to the lead wires.

2) Be sure to connect the load before power is applied.

When an auto switch is connected without a load to the power source and the auto switch is switched ON, the switch will be instantly damaged because of excess current.

3) Confirm proper insulation of wiring.

Be sure that there is no faulty wiring insulation (contact with other circuits, ground fault, improper insulation between terminals, etc.). Damage may occur due to excess current flow into the switch.

4) Do not wire with power or high voltage cables.

Wire separately from power or high voltage cables, avoiding parallel wiring in the same conduit. Control circuits containing auto switches may malfunction due to noise from these cables.

5) Do not allow short circuit of loads.

If the power is turned ON with a load in a short circuited condition, the switch will be instantly damaged because of excess current flow into the switch.

6) Avoid incorrect wiring.

A 24 VDC switch with indicator LED has polarity. The brown lead wire is (+), and the blue lead wire is (-).

\*If connections are reversed, the switch will operate, however the LED will not turn ON.

Also note that a current greater than that specified will damage the LED and it will no longer operate.

### Operating Environment

1) Never use in an atmosphere of explosive gases.

The structure of an auto switch is not intended to prevent explosion. Never use in an atmosphere with an explosive gas since this may cause a serious explosion.

2) Do not use in an area where a magnetic field is generated.

Auto switches can malfunction or magnets inside cylinders (actuator) can become demagnetized.

3) Do not use in an environment where the auto switch will be continually exposed to water.

Although switches satisfy IEC standard IP67 construction (JIS C 0920: watertight construction), avoid using switches in applications continually exposed to water splash or spray. Poor insulation or swelling of the potting resin inside switches may cause malfunction.

4) Do not use in an environment with oil or chemicals.

Consult SMC if auto switches will be used in an environment with coolant, cleaning solvent, various oils or chemicals. If auto switches are used under these conditions for even a short time, they may be adversely affected by improper insulation, malfunction due to swelling of the potting resin, or hardening of the lead wires.

5) Do not use in an environment with temperature cycles.

Consult SMC if switches are to be used where there are temperature cycles other than normal air temperature changes, as there may be adverse effects inside the switches.

### Operating Environment (continued)

6) Do not use in an environment where there is excessive impact shock.

When excessive impact (300 m/s<sup>2</sup> or more) is applied to a reed switch during operation, the contact point will malfunction or cut off a signal momentarily (1 ms or less). Consult SMC regarding the need to use a solid state auto switch depending upon the environment.

7) Avoid accumulation of iron waste or close contact with magnetic substances.

When a large amount of iron waste such as machining chips or spatter is accumulated, or a magnetic substance (something attracted by a magnet) is brought into close proximity with an auto switch cylinder, it may cause the auto switch to malfunction due to a loss of the magnetic force inside the actuator.

### Maintenance

1) Perform the following maintenance periodically in order to prevent possible danger due to unexpected auto switch malfunction.

1) Securely tighten switch mounting screws.

If screws become loose or the mounting position is dislocated, retighten them after readjusting the mounting position.

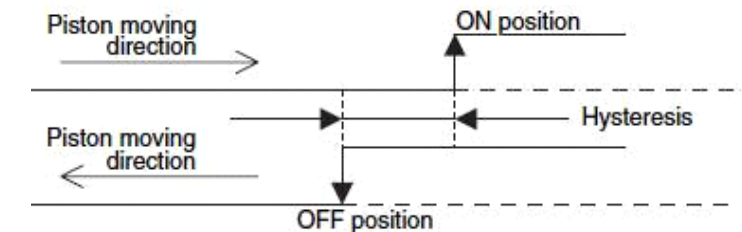
2) Confirm that there is no damage to lead wires.

To prevent faulty insulation, replace switches or repair lead wires, etc., if damage is discovered.

Others

1) For durability against water, flexible durability of the wire, application in a welding site, please consult SMC.

2) If ON and OFF position (hysteresis) cause problems, please consult SMC.



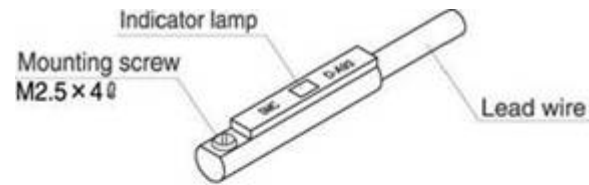
### Specifications

Model number	D-A93	D-A93V	D-A96 D-A96V	D-A90 / D-A90V
Wiring style	2 wire type		3 wire type	2 wire type
Application	PLC(*)		IC circuit	PLC, IC circuit
Load voltage	24 VDC		4 to 8 VDC	24 V AC/DC or less 48 V AC/DC
Load current	5 to 40 mA		20 mA or less	50 mA or less 40 mA or less
Internal voltage drop	2.4 V or less (up to 20 mA) 3 V or less (up to 40 mA)	2.7 V or less	0.8 V or less	—
Internal resistance	—			1 Ω or less (including 3 m lead wire)
Contact protection circuit	None			
Operating time	1.2 ms			
Indicator LED	Red LED lights when ON		—	
Impact Proof	300 m/s <sup>2</sup>			
Insulation resistance	50 MΩ or more at 500 VDC mega (between lead wire and case)			
Withstand voltage	1500 VAC for 1 minute (between lead wire and case)			
Ambient temperature	-10 to +60°C			
Enclosure	IEC 60529 standard IP67, JISC0920			

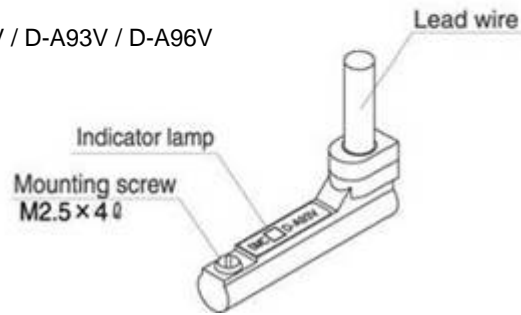
\*PLC (Programmable Logic Controller)

## Names and Function of Parts

D-A90 / D-A93 / D-A96



D-A90V / D-A93V / D-A96V

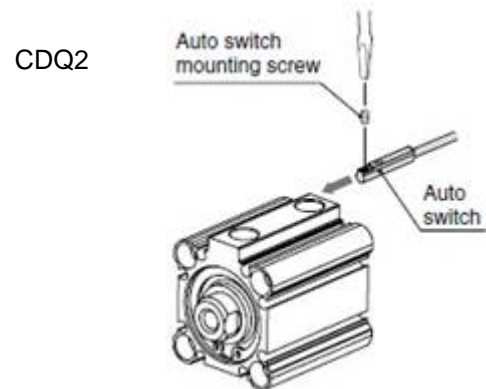


## Installation

How to mount / Mounting bracket

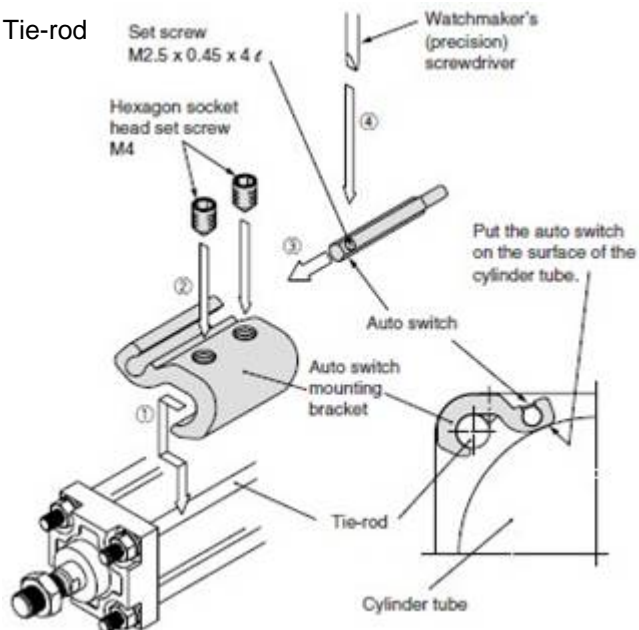
Each actuator has a specified mounting bracket for mounting the auto switch.

“How to mount / Mounting bracket” depends on the actuator type and the tube I.D. Please refer to the actuator catalogue. When an auto switch is mounted for the first time, ensure that the actuator is a type including a built in magnet, and select a bracket corresponding to the actuator.



When tightening the auto switch mounting screw (M2.5), use a small flat blade screwdriver with a grip diameter of 5 to 6 mm. The required tightening torque is 0.1 to 0.2 Nm.

Tie-rod



## Installation (continued)

- 1) Tie-rod mounting: Fix the auto switch in the detecting position with the M2.5 set screw using an auto switch mounting bracket on a cylinder tie-rod, with the bottom surface of the auto switch firmly in contact with the cylinder tube.
- 2) Fix in the required detecting position with a set screw (M4) using a hexagon driver.
- 3) Direct mounting: Fit the auto switch into the auto switch mounting groove and set it roughly in the detecting position.
- 4) After confirming the detecting position, tighten the mounting screw (M2.5) attached, and secure the auto switch.
- 5) When changing the detecting position, repeat from step 3.

Note1) To protect auto switches, ensure that the main body of the auto switch is inserted into the mounting groove with a depth of 15mm or more.

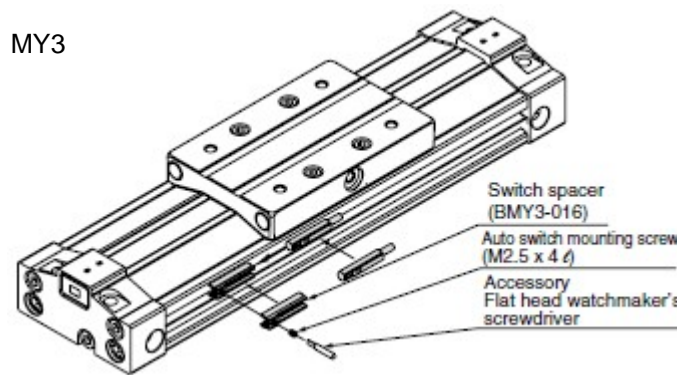
Note2) The required tightening torque of the hexagon socket head set screw (M4) is 1 to 1.2 Nm.

Note3) When tightening an auto switch mounting screw (M2.5), use a small flat blade screwdriver with a grip diameter of 5 to 6 mm.

The required tightening torque is 0.05 to 0.15 Nm.

As a guide, turn 90° from the position where it begins to feel tight.

MY3



When attaching an auto switch, first insert a switch spacer into the switch mounting groove.

When doing this, confirm that it is set in the correct mounting orientation, or re-insert if necessary.

Next, insert the auto switch into the groove and slide it until it is positioned under the switch spacer.

After establishing the mounting position, use a small flat blade screwdriver to tighten the switch mounting screw.

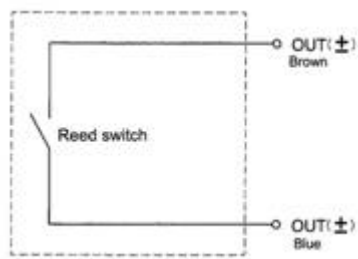
Note) When tightening the auto switch mounting screw (M2.5), use a small flat blade screwdriver with a grip diameter of 5 to 6 mm.

The required tightening torque is 0.05 to 0.1 Nm.

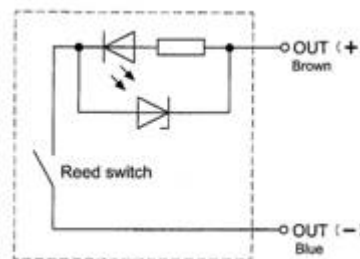
As a guide, turn 90° from the position where it begins to feel tight.

## Internal Circuit and Wiring

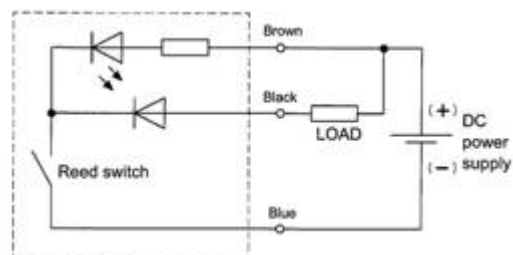
D-A90 / D-A90V



D-A93 / D-A93V

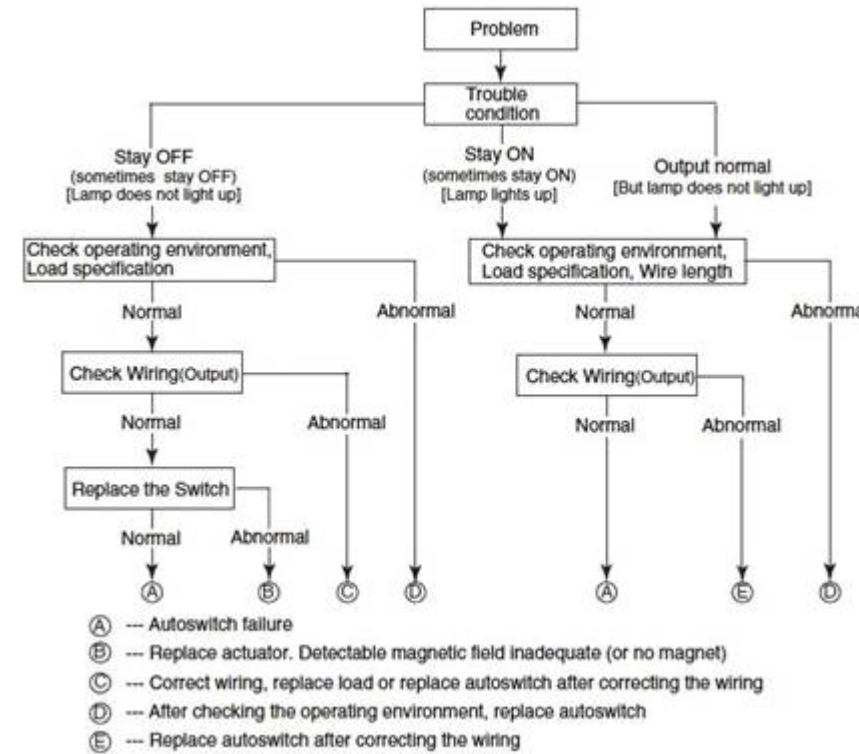


D-A96 / D-A96V



## Troubleshooting

When detection failure occurs (stay ON / OFF), please check based on the following flow chart.

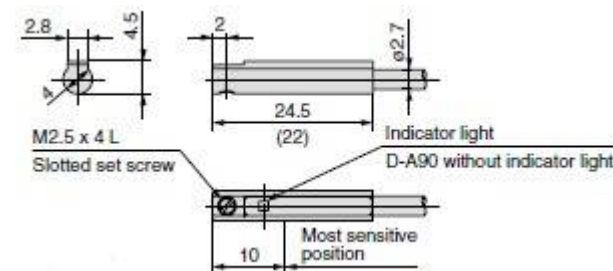


## Limitations of Use

Any use in an EN ISO 13849 system must be within the specified limits and application conditions. The user is responsible for the specification, design, implementation, validation and maintenance of the safety system (SRP/CS).

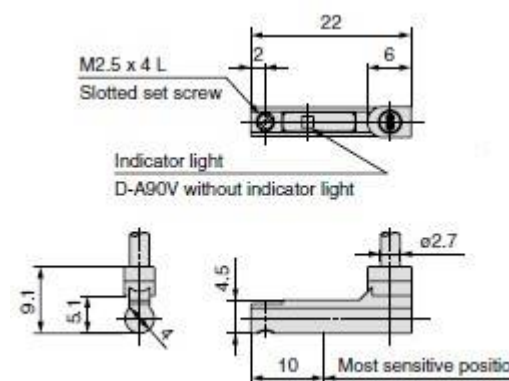
## Outline with Dimensions (mm)

D-A90 / D-A93 / D-A96



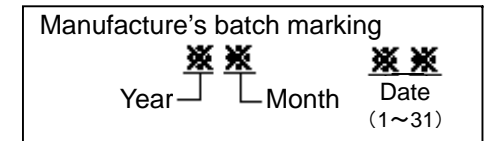
( ): dimensions for D-A96

D-A90V / D-A93V / D-A96V



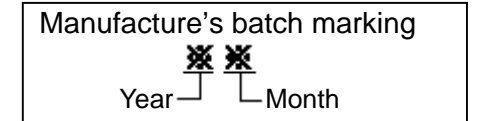
## Batch Marking

D-A90/D-A93



Mark	Year	Mark	Month
7	2007	1	January
8	2008	2	February
9	2009	3	March
0	2010	4	April
		5	May
		6	June
		7	July
		8	August
		9	September
		X	October
		Y	November
		Z	December

D-A96/D-A90V/D-A93V/D-A96V



Mark	Year	Mark	Month
7	2007	1	January
8	2008	2	February
9	2009	3	March
0	2010	4	April
		5	May
		6	June
		7	July
		8	August
		9	September
		X	October
		Y	November
		Z	December

## Contacts

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GERMANY	(49) 6103 4020	SLOVENIA	(386) 73 885 412
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